

THE PROTURA FROM LIUPAN MOUNTAIN, NORTHWEST CHINA

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Abstract The *Huashanentulus huashanensis* Yin, 1980 is redescribed, including the supplemental description of larva I, larva II and preimago stages as well as the electron microscope description of the calyx of maxillary and pores on the body. *H. liupanensis* sp. nov. is described and compared with the *H. huashanensis*. The new species is characterized by the short maxillary gland and extremely long sensillum a on foretarsus. The list of 15 species of Protura from Liupan Mountain area is also provided.

Key words Protura, new species, Liupan Mountain, China

1 Introduction

Liupan Mountain is located in Northwest China, between the border of Ningxia, Shaanxi and Gansu Provinces, which is a north-south directional mountain with altitude 2 000-2 900 m. The vegetation of Liupan Mountain is composed by temperate coniferous forest, deciduous broad-leaved forest, bush, grassland and meadow.

There is few record of Protura from Liupan

Table 1 Locations collected in Liupan Mountain area

Locations	Date	Latitude	Longitude	Altitude (m)
Shatang	31 May 2006	35° 34' N	105° 59' E	1 950
Sutai	21 June 2008	35° 26' N	106° 11' E	2 150
Dongshapo	23 June 2008	35° 35' N	106° 14' E	2 300
Fengtai	25 June 2008	35° 35' N	106° 12' E	2 400
Heshangpu	27 June 2008	35° 40' N	106° 13' E	2 300
Woyangchuan	29 June 2008	35° 38' N	106° 22' E	1 800
Luyuan	1 July 2008	35° 45' N	106° 12' E	2 234
Guangagou	3 July 2008	35° 46' N	106° 20' E	2 227
Qiuqianja	5 July 2008	35° 33' N	106° 24' E	1 841
Longtan	7 July 2008	35° 22' N	106° 20' E	2 000
Erlonghe	9 July 2008	35° 22' N	106° 16' E	2 200
Hongxia	11 July 2008	35° 27' N	106° 18' E	2 082
Xikia	3 July 2009	35° 29' N	106° 17' E	2 120

Totally at least 2 000 specimens in 9 genera 15 species were collected during the expeditions. *H. huashanensis* is the predominant species occupying nearly half of the specimens; however, this species was not well described in the original paper (Yin, 1980) and the monograph of Yin (Yin, 1999) because of shortage of specimens at that time. In present paper we give a full description of *H. huashanensis* based on the new collections. A new species of *Huashanentulus* from the material is described here. A

Mountain. Only one species *Nosekiella sinensis* Bu et Yin, 2008 was reported in this area (Bu and Yin, 2008). During the Summer of the years 2006, 2008 and 2009, we made three expeditions in this area in which 13 locations from one neighbor town and 12 forest farms of Liupan Mountain Natural Reserve were investigated. The information for locations collected in Liupan Mountain area is showed in Table 1.

list of Protura from Liupan Mountain area is also provided.

2 Material and Methods

The specimens were collected using Tullgren funnels. All specimens were mounted on the slide using Hoyer's medium and dried for three days in an oven at 60 °C. Type specimens are deposited in Shanghai Entomological Museum (SEM), Institute of Plant Physiology & Ecology, Shanghai Institutes for

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Biological Sciences Chinese Academy of Sciences Abbreviations used in the text see the paper of Bu and Yin (2007).

3 Description

Acerentomidae Silvestri 1907.

Tuxentulinae Yin 1983

Huashanentulus huashanensis Yin 1980 (Figs 1-10)

Holotype 1 male from Hua Mountain, Shaanxi Province, China 15 Aug 1978 collected by GUO PeiFu

Material examined Sutaj 1 female (No NX-LP-P08005), 1 male (No NX-LP-P08006), 1 preimago (No NX-LP-P08030), 5 maturus juniors (Nos NX-LP-P08031-NX-LP-P08035), 5 larva II (Nos NX-LP-P08040-NX-LP-P08044). Dongshanpo 2 females (Nos NX-LP-P08073-NX-LP-P08074), 1 preimago (No NX-LP-P08092). Fengtai 1 female (No NX-LP-P08099), 1 male (No NX-LP-P08100), 1 preimago (No NX-LP-P08101). Heshangpu 2 males (Nos NX-LP-P08115-NX-LP-P08117), 2 larva I (Nos NX-LP-P08129-NX-LP-P08130). Woyangchuan 1 female (No NX-LP-P08154), 1 male (No NX-LP-P08159). Luyuan 1 female (No NX-LP-P08180), 1 preimago (No NX-LP-P08181). Guanagou 1 female (No NX-LP-P08185), 1 male (No NX-LP-P08187), 1 preimago (No NX-LP-P08205). Qiuqianjia 1 female (No NX-LP-P08245). Longtan 1 female (No NX-LP-P08252), 1 male (No NX-LP-P08273), 1 larva I (No NX-LP-P08264). Erbnghe 2 females (Nos NX-LP-P08294-NX-LP-P08303). Hongxia 1 female (No NX-LP-P08314), 1 male (No NX-LP-P08308), 1 larva I (No NX-LP-P08327). Xixia 1 male (No NX-LP-P09001), 1 larva I (No NX-LP-P09006). All specimens were collected by Mr HUANG Cheng-Wang CHEN Wan-Jun and BU Yun

Diagnosis *H. huashanensis* is the type species of genus *Huashanentulus*. It is characterized by the maxillary gland with smooth calyx and one helmet-like appendix, filiform sensillum *t*-1 on foretarsus, well developed striate band on abdominal segment VIII and 4/2 setae on urostemite VIII.

Description Adult Body length 1250-1450 μm ($n = 30$).

Head Elliptic length 133-150 μm , width 88-110 μm ($n = 30$), with one anterior middle pore Postpseudocular seta present Additional seta absent Pseudoculus length 7.5-10.0 μm , width 10 μm . PR = 17.7-18.7 (Fig 1). Canal of maxillary gland long and with blind part bulked. Calyx smooth, with one distinct helmet-like appendix. Posterior filament of maxillary gland length 30-33 μm . CF = 4.1-5.2 (Fig

2). Maxillary palp with two seta-like sensilla subequal (Figs 3-4). Labial palp well developed with apical tuft and one leaf-like sensillum (Fig 5).

Thorax Chaetotaxy as shown in Table 2 Mesonotum and metanotum with 2 pairs of anterior seta (*A* 2 and *A* 4), setae *P* 1a and *P* 2a short and small *P* 5a short cone-shaped Length ratio of *P* 1: *P* 1a : *P* 2 on mesonotum as 2.3-2.7: 1.0: 3.7-4.0. Pronotum with no pores on mesonotum and metanotum with pore *l*. Stema of thorax without pore

Foretarsal length 95-105 μm , claw length 23-28 μm , with one inner flap in some specimens TR = 4.2-4.8. Empodium length 5.0-7.5 μm , EU = 0.22-0.25. Dorsal sensillum *t*-1 filiform, BS = 0.85-0.95; *t*-2 thick, *t*-3 small and lanceolate. Exterior sensillum *a* thick, surpassing base of *c* and *d*; *b* filiform, surpassing base of *y*; *c* short and thick, about half length of *b*; *d* filiform and long nearer to *e* than to *c*; sensillum *e* short and thick, reaching base of *f*; *f* robust and long, surpassing base of claw; *g* short and slim (Fig 7). Interior sensillum *a'* slim, distal to *t*-1; *b'* absent; *c'* thin and long, its apex surpassing base of claw. Setae β 4 and β 1 in normal shape (Fig 8). Length formula of foretarsal sensilla as *t*-3 < *c* = *e* < *b* = *t*-1 < *g* < *a'* < *a* = *t*-2 = *c'* < *d* < *f* (Figs 7-8). Middle tarsal length 43-48 μm , claw length 18-23 μm . Hind tarsal length 48-55 μm , claw length 18-23 μm .

Abdomen Chaetotaxy as shown in Table 2 Urotergite I with 3 pairs of anterior seta (*A* 1, *A* 2, *A* 5), with 5 pairs of posterior seta, posterior *P* 1a absent. Urotergites II-VI with 4 pairs of anterior seta II-III with 6 pairs of posterior seta *P* 1a and *P* 4a lacked, IV-VI with 7 pairs of posterior seta, only *P* 1a lacked. Seta *P* 3 on urotergite II-VI situated anterior to level of *P* 2. Urotergite VII with 8 pairs of posterior seta *P* 1a present. Accessory setae on urotergites II-VI short hair-like, on VII also short hair-like and slightly longer than on II-VI. Urotergite I with pore *pm*, other pores absent. Urotergites II-VI each with pores *al* and *pm*. Urotergite VII with pore *pm*. One membranal pores present on the anterior part of membrane between laterotergite and stemite of abdominal segments VI-VII.

Abdominal legs II-III slim, each with 2 subequal setae, the ratio of subapical seta and apical seta as 1.0: 1.2. Accessory setae on urostemites I-VII short hair-like. Urostemites I-VII each with one middle pore. Striate band on abdominal segment VIII well developed (Fig 6). Segment VIII with paired pore *pm* on urotergite which with distinct surrounding teeth. Comb on abdomen VIII posteriorly rounded and protrudes backwards with 20-22 similar teeth on hind margin (Fig 9).

Segments IX-XI without pores on urotergites and

Table 2. Chaetotaxy of *Huashanentulus huashanensis* Yin, 1980.

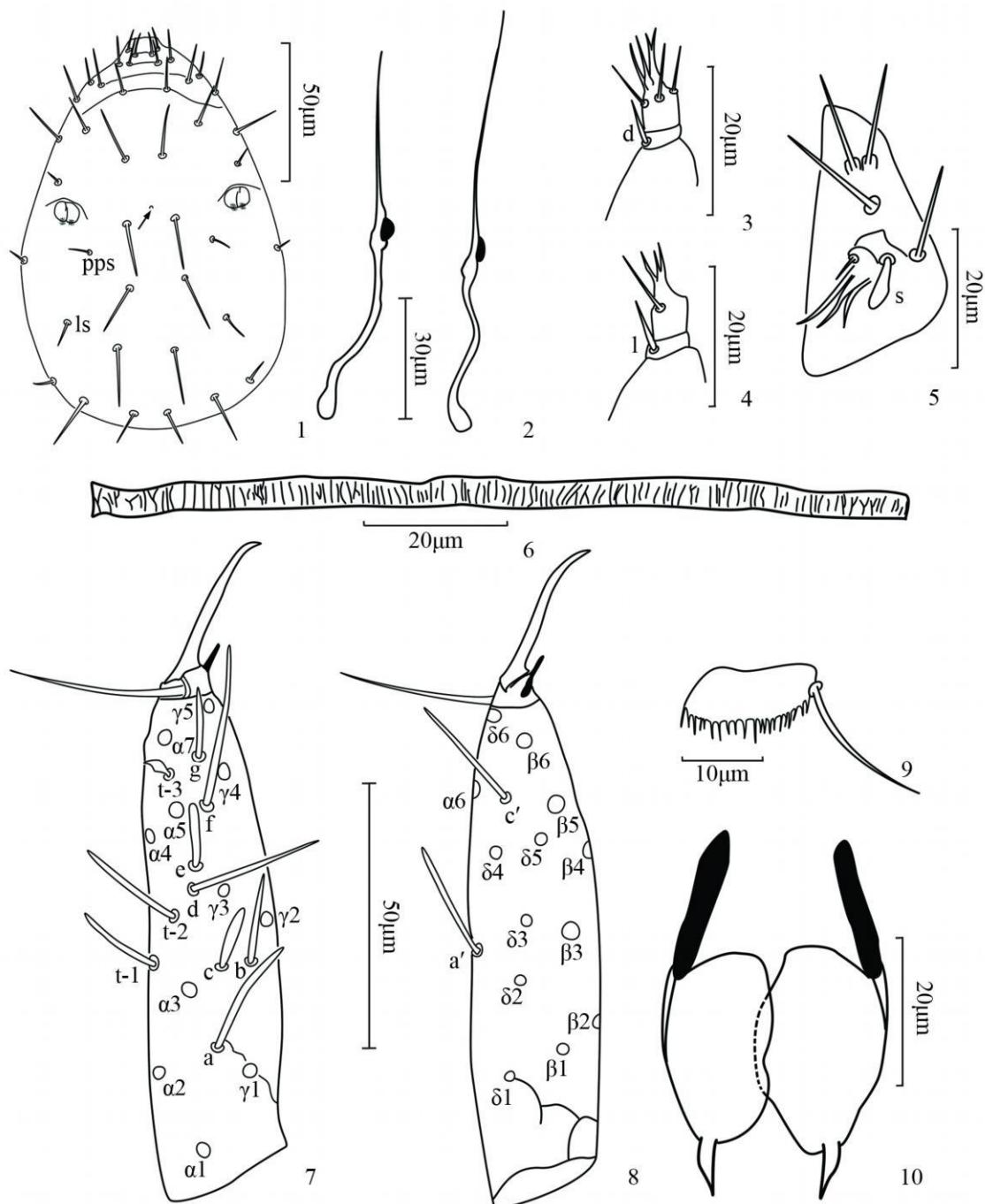
Larva I		Larva II		Maturus Junior		Imago		
Dorsal	Formula	Composition of Setae	Formula	Complementary Setae	Formula	Complementary Setae	Formula	Complementary Setae
Thorax I	4	1, 2	4		4		4	
II - III	$\frac{4}{10}$	<i>A2, M</i> <i>P1, 2, 3, 4, 5a</i>	$\frac{6}{12}$	<i>A4</i> <i>P5</i>	$\frac{6}{14 (16)}$	<i>P2a (1a)</i>	$\frac{6}{16}$	<i>P1a</i>
Abdomen I	$\frac{0}{8}$	<i>P1, 2, 3, 4</i>	$\frac{0}{10}$	<i>P5</i>	$\frac{6}{10}$	<i>A1, 2, 5</i>	$\frac{6}{10}$	
II - III	$\frac{0}{10}$	<i>P1, 2, 3, 4, 5</i>	$\frac{0}{12}$	<i>P2a</i>	$\frac{6}{12}$	<i>A1, 2, 5</i>	$\frac{8}{12}$	<i>A4</i>
IV - VI	$\frac{0}{10}$	<i>P1, 2, 3, 4, 5</i>	$\frac{0}{14}$	<i>P2a, 4a</i>	$\frac{6}{14}$	<i>A1, 2, 5</i>	$\frac{8}{14}$	<i>A4</i>
VII	$\frac{0}{10}$	<i>P1, 2, 3, 4, 5</i>	$\frac{0}{14}$	<i>P2a, 4a</i>	$\frac{6}{16}$	<i>A1, 4, 5</i> <i>P1a</i>	$\frac{8}{16}$	<i>A3</i>
VIII	$\frac{0-6}{6}$	<i>M2, 3, 4</i> <i>P2, 3, 5</i>	$\frac{2-9}{6}$	<i>A5, Mc, 5</i>	$\frac{8-9}{6}$	<i>A2, 3, 4</i>	$\frac{8-9}{6}$	
IX			8	1, 2, 3, 4	10	1, 2, 3, 4, 5	12	1a
X					8	1, 2, 4, 5	10	3
XI					6	1, 2, 3	6	
XII	9		9		9		9	
Ventral								
Thorax I	$\frac{2-2}{4}$	<i>A1, M1</i> <i>P1, 2</i>	$\frac{2-2}{4}$		$\frac{2-4}{6}$	<i>M2</i> <i>P3</i>	$\frac{2-4}{6}$	
II	$\frac{5-0}{2}$	<i>Ac, 2, 3</i> <i>P1</i>	$\frac{5-2}{2}$	<i>M</i>	$\frac{5-2}{4}$	<i>P2</i>	$\frac{5-2}{4}$	
III	$\frac{5-0}{2}$	<i>Ac, 2, 3</i> <i>P1</i>	$\frac{5-2}{2}$	<i>M</i>	$\frac{7-2}{4}$	<i>A4</i> <i>P2</i>	$\frac{7-2}{4}$	
Abdomen I	$\frac{0}{2}$	<i>P1</i>	$\frac{3}{2}$	<i>Ac, 2</i>	$\frac{3}{2}$		$\frac{3}{2}$	
II - III	$\frac{0}{3}$	<i>Pc, 3</i>	$\frac{1}{5}$	<i>Ac</i> <i>P2</i>	$\frac{3}{5}$	<i>A2</i>	$\frac{3}{5}$	
IV - VI	$\frac{1}{4}$	<i>Ac</i> <i>P1, 2</i>	$\frac{1}{6}$	<i>P3</i>	$\frac{3}{8}$	<i>A2</i> <i>P1a</i>	$\frac{3}{8}$	
VII	$\frac{1}{4}$	<i>Ac</i> <i>P1, 2</i>	$\frac{1}{6}$	<i>P3</i>	$\frac{3}{8}$	<i>A2</i> <i>P1a</i>	$\frac{3}{8 (9)}$	(<i>Pc</i>)
VIII	$\frac{2}{0}$	<i>A1</i>	$\frac{4}{0}$	<i>A2</i>	$\frac{4}{2}$	<i>P1</i>	$\frac{4}{2}$	
IX			4		4		4	
X					4		4	
XI					2	2	6	1, 3
XII	8		8		6		6	

urosternites Segment XI with 3 + 3 short setae on urotergite, and setae 1 and 3 on urosternite long. Single middle pore present on the urotergite XII, and paired pores also present on urosternite XII. Female squama genitalis with pointed acrostyle (Fig. 10).

Younger instars The measurements and indices of younger instars as shown in the Table 3

Chaetal variability Larva I: no variability observed. Larva II: urosternites II - III lack seta *Ac* (Nos NX-LP-P08042, NX-LP-P08043, NX-LP-

P08044). Maturus Junior mesonotum and metanotum asymmetrically with seta *P1a* at one side with 6/15 chaetotaxy (Nos NX-LP-P08033, NX-LP-P08034, NX-LP-P08035), urotergite VII asymmetrically with seta *A2* at one side with 7/16 chaetotaxy (No NX-LP-P08034). Preimagina mesonotum and metanotum asymmetrically lack seta *P1a* at one side with 6/15 chaetotaxy (Nos NX-LP-P08030, NX-LP-P08181). Imagina urotergite I with seta *P1a*, with 6/12 chaetotaxy (Nos NX-LP-



Figs 1-10 *Huashanentulus huashanensis* Yin, 1980. 1 Head, dorsal view (arrow show themiddle pore). 2 Canal of maxillary gland. 3 Maxillary palpus, dorsal view. 4 Maxillary palpus, lateral view. 5 Labium, exterior view. 6 Striate band on abdominal segment VIII. 7. Foretarsus, exterior view. 8. Foretarsus, interior view. 9. Comb on abdominal segment VIII. 10. Female squama genitalis.

P08302 NX-LP-P08303 NX-LP-P08308), urotergite III with seta P_{4a} , with 8/14 chaetotaxy (No NX-LP-P08314), urotergite VI with seta P_{1a} , with 8/16 chaetotaxy (Nos NX-LP-P08302 NX-LP-P08303 NX-LP-P08308 NX-LP-P08314), urotergites II - VI with 8/16 chaetotaxy, each with setae P_{1a} and P_{4a} (observed in 3 females and 1 males from Taizimountain Linxia Gansu).

Distribution China (Ningxia Shaanxi Gansu

Sichuan Hubei).

Remarks The hebet-like appendix on the calyx of maxillary gland is an important character of Acerentomidae. This structure was mentioned in the original description of *H. huashanensis* but not showed in the figures because the angle of the specimen mounted on the slides. In this paper we observed distinctive hebet-like appendix in many specimens so we modified the drawing of maxillary gland. In addition

Table 3 Body measurements (in μm) and indices of the younger instars

	Preimago	Metanous junior	Larva II	Larva I
Head length	128-130	125	110-118	95-98
Pseudoculus	7.5	7.5	6.3-7.5	6.3-7.5
PR	16.0-17.3	16.7	15.7-18.8	12.7
Maxillary gland	30	30	23-28	18-20
CF	4.0-4.4	4.2	4.1-4.9	4.8-5.4
MesonalP 1	17-18	16-17	15-16	10-11
MesonalP 1a	7-8	7-8	-	-
MesonalP 2	25-28	23-25	20-21	14-15
Foretarsus	83-90	83-85	63-73	55-58
BS	0.74-0.89	0.70-0.83	0.71-0.87	0.57-0.77
Claw	18-23	20	18-20	13-15
TR	4.1-4.7	4.1-4.3	3.4-4.2	3.7-4.8
Empodium	5	5	5	2.5-3.8
EU	0.25-0.29	0.25	0.25-0.29	0.17-0.20
Middle tarsus	38-40	40	33-35	30
Middle claw	15-18	13	13	13
hind tarsus	43-45	43	35-40	33
hind claw	18-29	15	15-18	15
Body length	1163-1238	1125-1188	838-1000	675-775
No. of specimens examined	5	5	5	5

the larva I, larva II and preimago was not described in the past because of shortage of specimens in this paper we supplement the information of these younger stars Also the pores on the body were described

Huashanellus liupanensis sp. nov. (Figs 11-22)
 Holotype female (No NX-LP-P08085), Ningxia Jingyuan Dongshampo forest farm ($35^{\circ}35'N$, $106^{\circ}14'E$; alt 2300m), from coniferous forest of Liupan mountain, 23 June 2008. Paratypes 2 females (Nos NX-LP-P08182 NX-LP-P08183), Ningxia Guyuan Luyuan Forest Farm ($35^{\circ}45'N$, $106^{\circ}12'E$; alt 2234 m), from coniferous forest of Liupan Mountain, 1 July 2008. 1 female (No NX-LP-P08224), Ningxia Jingyuan Erlonghe Forest Farm ($35^{\circ}22'N$, $106^{\circ}16'E$; alt 2200 m), from broad-leaved forest of Liupan Mountain, 3 July 2008. 1 female (No NX-LP-P08228), Ningxia Pengyang Guanagou forest farm ($35^{\circ}46'N$, $106^{\circ}20'E$; alt 2227 m), from broad-leaved forest of Liupan Mountain, 9 July 2008. 1 larva II (No NX-LP-P08048), Ningxia Longde Sutai Forest Farm ($35^{\circ}26'N$, $106^{\circ}11'E$; alt 2150 m), from broad-leaved forest of Liupan mountain, 21 June 2008. All type specimens were collected by Mr HUANG Cheng-Wang and BU Yun deposited in Shanghai Entomological Museum (SEM).

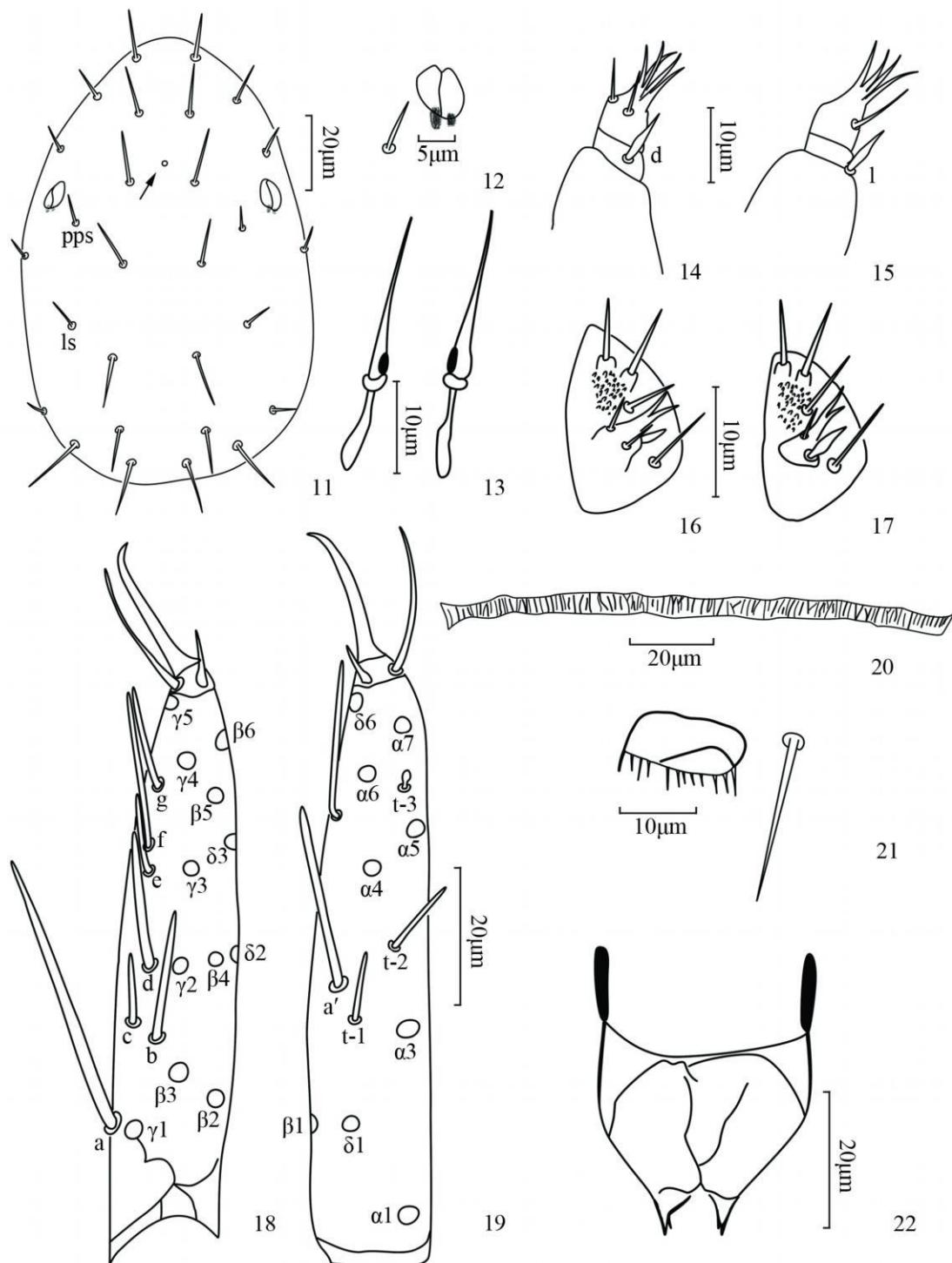
Diagnosis The new species *H. liupanensis* sp. nov. is characterized by the short maxillary gland, extremely long sensillum *a* on the foretarsus and granules on the labial region

Description Adult Body length 1113-1300 μm ($n=5$).

Head Elliptic length 115-120 μm , width 76-86 μm ($n=5$), with one anterior middle pore Postpseudocular seta present Additional seta absent (Fig 11). Pseudoculus length 7-8 μm , width 6-7 μm . PR = 14.3-16.4 (Fig 12). Canal of maxillary gland short with posterior part buckled Calyx smooth with one helmet like appendix Posterior filament of maxillary gland length 13-14 μm . CF = 9.6-11.5 (Fig 13). Maxillary palp with two sensilla subequal (Figs 14-15). Labial palp well developed with apical tuft and one leaf like sensillum. The articles anterior to the base of Labial palp decorated with some granules (Figs 16-17).

Thorax Chaetotaxy as shown in Table 4 Mesonotum and metanotum with 2 pairs of anterior seta (*A* 2 and *A* 4), seta *P* 1a absent seta *P* 2a short and small and seta *P* 5a short cone-shaped Length ratio of *P* 1: *P* 2 on mesonotum as 1.0: 1.2-1.5 Pronotum with no pores in mesonotum and metanotum with pore *l* and *al* Stema of thorax without pore

Foretarsal length 81-86 μm , claw length 19-21 μm TR = 4.1-4.3 Empodium length 4 μm , EU = 0.20-0.21. Dorsal sensillum *t*1 short filiform, BS = 0.65-0.73 *t*2 thin; *t*3 very small knob-shaped Exterior sensillum *a* extremely long and robust reading base of *f*, *b* filiform, slightly surpassing base of *Y* 2, *c* short and slim, about half length of *b*; *d* slightly broad and long nearer to *c* than to *e*,



Figs 11–22 *Huashanentulus liupanensis* sp. nov. 11. Head dorsal view (arrow show the middle pore). 12. Pseudoculus. 13. Canal of maxillary gland. 14. Maxillary palpus dorsal view. 15. Maxillary palpus lateral view. 16. Labium, anterior view. 17. Labium, exterior view. 18. Foretarsus exterior view. 19. Foretarsus interior view. 20. Striate band on abdominal segment VIII. 21. Comb on abdominal segment VIII. 22. Female genitalia

sensillum *e* short and slim, *f* filiform, reaching base of claw; *g* short and slim (Fig. 18). Interior sensillum *a'* thick distal to *t-1* (Fig. 18); *b'* absent; *c'* thin and long its apex reaching base of claw (Fig. 19). Setae δ_4 and β_1 in normal shape. Length formula of foretarsal sensilla as $t-3 < c < e = t-1 = t-2 < g < b$

$< d < f = c' < a' < a$ (Figs 18–19). Middle tarsal length 33–35 μ m, claw length 18–20 μ m. Hind tarsal length 36–40 μ m, claw length 18–23 μ m

Abdomen Chaetotaxy as shown in Table 4. Urotergite I with 2 pairs of anterior seta (*A* 1, *A* 2), with 5 pairs of posterior seta. seta *P* 1a absent

Urotergites II-VI with 3 pairs of anterior seta, 6 pairs of posterior seta setae $P1a$ and $P2a$ lacked. Seta $P2$ on urotergite II-VI situated anterior to level of $P2$. Urotergite VII with 8 pairs of posterior seta $P1a$ and $P2a$ present. Accessory setae on urotergites II-VII short hair-like. Urotergite I with pore pm , other pores absent. Urotergites II-VI with pores al and pm . Urotergite VII with pore pm .

Abdominal legs II-III with 2 subequal setae, the ratio of subapical seta and apical seta as 1.0:1.1. Accessory setae on urostemites I-VII short hair-like.

Table 4 Chaetotaxy of *Huashanentulus liupanensis* sp. nov.

	Larva II		Imago	
	Formula	Composition of Setae	Formula	Composition of Setae
Dorsal				
Thorax I	4	1, 2	4	1, 2
II	6/12	$A2, 4 M$ $P1, 2, 3, 4, 5, 5a$	6/14	$A2, 4 M$ $P1, 2, 2a, 3, 4, 5, 5a$
III	6/12	$A2, 4 M$ $P1, 2, 3, 4, 5, 5a$	6/14	$A2, 4 M$ $P1, 2, 2a, 3, 4, 5, 5a$
Abdomen I	0/8	$P1, 2, 3, 4$	4/10	$A1, 2$ $P1, 2, 3, 4, 5$
II-VI	0/12	$P1, 2, 3, 4, 4a, 5$	6/12	$A1, 2, 5$ $P1, 2, 3, 4, 4a, 5$
VII	0/14	$P1, 1a, 2, 3, 4, 4a, 5$	6/16	$A1, 2, 5$ $P1, 1a, 2, 2a, 3, 4, 4a, 5$
VIII	2-6/6	$A3, M2, 3, 4$ $P2, 3, 4$	6/7	$A2, 4, 5, M\zeta, 2, 3, 4$ $P2, 3, 4, 5$
IX			12	1, 1a, 2, 2a, 3, 4
X			10	1, 2, 2a, 3, 4
XI	8		6	
XII	9		9	
Ventral				
Thorax I	2-2/4	$A1, M1$ $P1, 2$	2-4/6	$A1, M1, 2$ $P1, 2, 3$
II	5-2/2	$A\zeta, 2, 3 M$ $P1$	5-2/4	$A\zeta, 2, 3, M$ $P1, 2$
III	5-2/2	$A\zeta, 2, 3 M$ $P1$	7-2/4	$A\zeta, 2, 3, 4 M$ $P1, 2$
Abdomen I	2/2	2 $P1$	3/2	$A\zeta, 2$ $P1$
II-III	1/3	$A\zeta$ $P\zeta, 2$	3/5	$A\zeta, 2$ $P\zeta, 2, 3$
IV-VI	1/6	$A\zeta$ $P1, 2, 3$	3/8	$A\zeta, 2$ $P1, 1a, 2, 3$
VII	1/6	$A\zeta$ $P1, 2, 3$	3/9	$A\zeta, 2$ $P\zeta, 1, 1a, 2, 3$
VIII	4	1, 2	4	1, 2
IX	4		4	
X			4	
XI			6	
XII	6		6	

Urosternites I-III without pores. Urostemites IV-VII each with one asymmetric pore pm . Striate band on abdominal segment VIII well developed (Fig. 20). Segment VIII with paired pore pm on urotergite without pores on urostemite. Comb on abdomen VIII rectangular with 9-12 similar teeth on hind margin (Fig. 21).

Segments IX-XI each with some teeth on the hind margin. Segments IX-XI without pores on urotergites and urostemites. Segment XI with 3+3 short setae on urotergite and setae 1 and 3 on urostemite long.

Table 5 Differences between *H. liupanensis* sp. nov. and *H. huashanensis* Yin, 1980

Characters	<i>H. liupanensis</i> sp. nov	<i>H. huashanensis</i> Yin, 1980
Proximal part of maxillary gland	Broad and short	Slim and long
Sensillum t_3 on foretarsus	Knob-like	Lanceolate
Sensillum a on foretarsus	Extremely long	Normal
Anterior setae of urotergites II-VI	3 pairs	4 pairs
Posterior setae of urotergites II-III	$P1a, P2a$ lacked	$P1a, P4a$ lacked
Posterior setae of urotergites IV-VI	$P1a, P2a$ lacked	$P1a$ lacked
Chaetotaxy of urostemite VIII	4/0	4/2
Chaetotaxy of urostemite VII	3/9	3/8 (9)
Comb on abdominal segment VIII	With 9-12 teeth	With 20-22 teeth

Single middle pore present on the urotergite XII, and paired pores al also present on urostemite XII.

Female squama genitalis with pointed acrostyles (Fig. 22).

Younger instars Larva II: body length 798 μm ($n = 1$). Head length 100 μm , width 68 μm . Pseudoculus length 6 μm , width 6 μm , PR = 16.7. Posterior filament of maxillary gland length 9 μm . CF = 11.1. Fortarsal length 65 μm ; claw length 13 μm ; TR = 5. Empodium length 3 μm , EU = 0.23, BS = 0.77; middle tarsal length 33 μm , claw length 15 μm . Hind tarsal length 35 μm , claw length 16 μm . Chaetotaxy as shown in Table 4. Other younger instars unknown.

Distribution China Ningxia

Etymology The species name derived from the name of Liupan Mountain where the type specimens being collected.

Remarks Only one species described in genus *Huashanentulus*, here we described the second species *H. liupanensis* sp. nov. The present new species with distinct helmet-like appendix on Calyx of maxillary, well developed labial pulp filiform sensillum t_1 on foretarsus and two pairs of anterior seta on mesonotum and metanotum, which indicate it is a member of Tuxenentulinae. This species can be easily distinguished from *huashanensis* by the shape of maxillary gland sensilla on foretarsus, the chaetotaxy on the body and the female genitalis (Table 5). The granule on the cuticles of labial region is a special character observed in *Protura*.

List of *Protura* from Liupan Mountain, Northwest China

The abbreviation Mjmaurus junio σ LII-larva II, LI-harva I. All specimens were collected by Mrs LUAN Yun-Xia, GAO Yan and Mr HUANG Cheng-Wang, CHEN Wan-Jun, BU Yun.

Esperentulus dinghaensis Yin, 1982

Known from Qinghai, Sichuan, Yunnan, Hubei and Gansu Provinces

Material examined Ningxia Province

Dongshangpo 2 females Fengtai 1 female 1 male Heshangpu 1 female Qiuqianjia 1 female 1 male Hongxia 1 LII.

Esperentulus pectigastrum Yin, 1984

Known from Shanxi, Hebei and Shaanxi Provinces

Material examined Ningxia Province Shatang 2 females Sutai 1 female Dongshangpo 1 female Heshangpu 3 females 2 male 1 LII, Longtan 2 females Hongxia 2 male

Proturentulus dinghaensis Yin, 1984

Known from Shanxi, Hebei, Shandong, Liaoning and Neimenggu Provinces

Material examined Ningxia Province Shatang 2 females Dongshangpo 1 female Guanagou 2 females

Baculentulus tianshanensis Yin, 1963

Known from Zhejiang, Shanghai, Jiangxi, Anhui, Hubei, Hunan, Sichuan, Chongqing, Guizhou, Yunnan, Henan, Hebei, Liaoning, Neimenggu and Shaanxi Provinces

Material examined Ningxia Province Shatang 2 females 2 male

Kenyentulus shenanensis Yin, 1983

Known from Henan, Zhejiang, Jiangxi, Hubei, Guizhou, Yunnan and Hainan Provinces

Material examined Ningxia Province Shatang 2 females

Kenyentulus jiuzaiensis Tang et Yin, 1986

Known from Sichuan and Gansu Provinces

Material examined Ningxia Province Sutai 2 females Dongshangpo 1 female Qiuqianjia 1 female 1 male 1 male Hongxia 1 female 1 male

Huashanentulus huashanensis Yin, 1980

Known from Shaanxi, Gansu, Sichuan and Hubei Provinces

Material examined Ningxia Province see the description above

Huashanentulus liupanensis sp. nov.

Known from Ningxia Province

Material examined Ningxia Province see the description above

Nosekiella sinensis Bu et Yin, 2008

Known from Qinghai Ningxia and Shaanxi Provinces

Material examined Ningxia Province
Heshangpu 1 female Guanagou 1 female
Erlonghe 4 females 1 preimago 4 m.j 1 LII.

Fujien tan on dicestum Yin, 1977

Known from Shanghai Zhejiang Jiangsu
Anhui Henan and Yunnan Provinces

Material examined Ningxia Province Shatang 1 male

Eosentomon orientalis Yin, 1979

Known from Shanghai Jiangsu Zhejiang
Anhui Jiangxi Hunan Hubei Sichuan
Chongqing Guizhou Guangxi Guangdong
Hainan Liaoning Qinghai and Shaanxi ProvincesMaterial examined Ningxia Province Shatang 2 females 2 males 1 LII, Shatang 3 females 1 male
Heshangpu 1 female Qiaqianjia 2 females Longtan 1 male

Eosentomon megalenum Yin, 1989

Known from Shanghai Jiangsu Shaanxi
Yunnan Guizhou Hubei Hunan and Sichuan Provinces

Material examined Ningxia Province Shatang 1 female Shatang 1 male Qiaqianjia 1 female 1 male

Eosentomon asahi Imadate, 1961

Known from China (Qinghai Heilongjiang
Jilin Liaoning Neimenggu Beijing) and Japan

中国西北六盘山区原尾虫研究

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摘要 通过研究中国西北六盘山区采集到的原尾虫标本, 对华山蠓 *Huashanentulus huashanensis* Yin, 1980 进行了重新描述, 补充了第I幼虫、第II幼虫和前成虫的描述, 重新描绘了颤腺结构图, 并描述了体表腺孔。同时记述华山蠓属1新种, 六盘华山蠓 *Huashanentulus liupanensis* sp. nov., 新种的主要特征是颤腺管粗短, 前足跗节上感器 a 极长大, 并与华山蠓进行了比较区别。文中列出了六盘山区原尾虫的种类名录, 共包括15种, 分别是青海夕蠓 *Hesperentomon chinghaiensis* Yin, 1982, 棘腹夕蠓 *H. pedigasterum* Yin, 1984, 中国原蠓 *Proturantom chinensis* Yin, 1984, 天目巴蠓 *Baicalentulus tianmuhanensis* Yin, 1963, 河南肯蠓 *Kenyentulus henanensis* Yin, 1983, 九寨肯蠓 *K. juzhaiensis* Tang et Yin, 1986, 华山蠓 *Huashanentulus huashanensis* Yin, 1980, 六盘华山蠓 *H. liupanensis* sp. nov., 中华诺蠓 *Nosekiella sinensis* Bu et Yin, 2008, 双腰富蠓 *Fujientomon dicestum* Yin, 1977, 东方古蠓 *Eosentomon orientalis* Yin, 1965, 大眼古蠓 *E. megalenum* Yin, 1989, 日升古蠓 *E. asahi* Imadate, 1961, 三纹拟异蠓 *Psaudanisentomon trilinum* Zhang et Yin, 1981, 小孔拟异蠓 *P. minysticum* Yin, 1979。新种模式标本保存在上海昆虫博物馆。

关键词 原尾虫, 新种, 六盘山, 中国。

中图分类号 Q969.11

Material examined Ningxia Province Sutai 3 females Woyangduan 1 female Qiaqianjia 3 females Longtan 1 female 1 m.j Hongxia 1 m.j

Psaudanisentomon trilinum Zhang et Yin, 1981

Known from Guangxi Guangdong Fujian
Jiangxi Guizhou Sichuan and Yunnan Provinces
Material examined Ningxia Province
Guanagou 1 female

Psaudanisentomon minysticum Yin, 1979

Known from Shanghai Jiangsu Zhejiang
Anhui Fujian Hubei and Yunnan Provinces

Material examined Ningxia Province Shatang 1 female 1 male

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